DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

WASHINGTON

Confidential Bulletin No. 5.

FJS:AER

March 8, 1918.

GENERAL NOTE.

The Bureau has received a number of inquiries from officers into whose hands these Confidential Bulletins have come, requesting to be supplied with publications on the subjects treated. Generally speaking, such publications are not available, since the investigations reported in these bulletins are of a current character and the work is ofttimes progressing more rapidly than can be followed in any formal publication. The intent of these announcements is that officers interested in the lines of work treated, may have opportunity to get in touch, whether by personal conference or by letter of inquiry, with the work going on, and obtain such specific data as may be needed for his particular purposes. When manuscript reports covering detailed results of tests and investigations conducted by the Bureau are available, copies can be supplied when necessary to the military and naval services; nevertheless, in view of the volume of such material, the Bureau requests of inquirers the fullest possible information regarding the use which is to be made of it, in order that unnecessary time and expense may not be incurred in the preparation of unessential compilations.

1 Electroplating. The present plan for the study of electrodeposition involves a concentration upon zinc plating solutions, since the preliminary corrosion tests have indicated the very great superiority of zinc plating over copper and nickel plating as a protection against corrosion. A study of the conditions most favorable for zinc coating is highly desirable in view of the fact that many of the solutions used in commercial plants have been treated as secret formulas; moreover, they do not in every case give entire satisfaction.

2 Aeronautic Recording Instruments. At the request of the Signal Corps, and the National Advisory Committee for Aeronautics, the Bureau is investigating the subject of suitable barographs for experimental work on aircraft. Difficulties of manufacturing instruments of this character which are designed to record the altitude of aircraft on a moving chart continuously during flight, are such that it has been necessary to give the subject special study to the end of providing reliable data as a basis upon which the manufacturer may work, and thus to reduce delay by carrying on the experimental work in the most efficient manner. Consideration is also being given to the important matter of dispensing with the use of ink as a medium of recording.

3 Anti-freezing Solutions. The study of anti-freezing solutions for radiators of motor trucks and other water-cooled motor vehicles has required considerable attention. A preliminary statement has been prepared from which the following conclusions are quoted: (1) Calcium chloride solutions should be used with caution, if at all, on account of their corrosive action; (2) Kerosene or similar oils should not be used on account of their inflammability, high boiling point and deteriorating effect on rubber; (3) Mixtures of glycerine and alcohol may be used, but the price of glycerine and the need for it in the manufacture of munitions should preclude its use;(4) Solutions made from either wood alcohol or denatured alcohol seem at the present time to be the most desirable solutions to use, If the wood alcohol is free from acid, there is little choice between the two alcohols. Wood alcohol costs more than denatured alcohol and is more volatile, but its lower freezing point permits a less amount to be used, which may counteract the above disadvantage.

4 Balloon Gases. A brief report has been made to the Signal Corps on the effect of impurities in balloon hydrogen upon the balloon fabrics, and a paper has been prepared upon methods of determining the permeability of balloon fabrics to hydrogen,

5 Vacuum Tube Data. A large number of important technical papers relating to vacuum tube amplifiers have been studied. These instruments have assumed great importance in the reception of radio signals; accordingly a digest of the information has been prepared and mimeographed for distribution to officers and engineers of the services concerned.

6 Telephone and Telegraph Equipment. The Bureau's equipment for investigating and testing telephones is being applied to various uses in military and naval work in which the highest accuracy of transmission is an essential factor. Studies are also being made relative to the sensitivity of radio instruments in the reception of signals under extraordinary conditions.

7 Chronometric Measurements. At the request of the Navy Department, the Bureau is conducting several difficult technical investigations requiring the development and use of devices for measuring and recording extremely small intervals of time.

8 Leather. In addition to the regular work on leather (including leather from fish skins) experiments are in progress here and at Camp Meade in cooperation with the military authorities on the effect of various greases and waterproofing compounds on the wearing qualities of sole leather.

9 Light Alloys.

The investigation which the Bureau has been making along this line has been directed principally to the following objects: (1) The development of the best possible casting alloy. (2) The development of the most suitable rolling and forging alloy, particularly for the manufacture of sheet and tubing used in

aircraft construction. (3) The study of the best heat treatment for rolling and forging alloys.

Owing to the fact that at present the Bureau does not possess facilities forrolling and forging alloys, much of this work has been carried out with the most effective and cordial cooperation of the Washington Navy Yard and of the Aluminum Company of America at its New Kensington plant.

Tests of Magnesium-Aluminum Alloys for rolling or forging.- The attractiveness of this series of alloys for aircraft construction lies in the fact of their lightness; the density of such alloys is less than that of aluminum or duralumin. Ingots have been cast of different compositions of magnesium ranging from 0 to 20 per cent., and their behavior during rolling or forging has been studied. It is not possible to roll or forge satisfactorily magnesium-aluminum alloys containing more than approximately 3 per cent. of magnesium. Such an alloy can be obtained with a tensile strength of from 30,000 to 35,000 pounds per square inch and an elongation of about 20 per cent. Higher results are obtained when there is also added a percent or so of copper.

Tests of Aluminum-Magnesium Alloys to which have been added, respectively, nickel, copper, manganese:- Three series of alloys have been prepared in the form of sheet consisting of various percentages of aluminum and magnesium, with nickel, manganese and copper. The physical properties of these alloys have been studied as rolled, in the annealed condition, and after heat treatment. The alloys of aluminum-magnesium-copper show a marked increase in the physical properties after heat treatment, amounting to as much as 50 percent., whereas alloys of aluminum-magnesium-manganese are not affected at all by heat treatment and the alloys of aluminum-magnesium-nickel, only very slightly.

It should not, however, be assumed from this that for all purposes the aluminum-magnesium-manganese and aluminum-manganese-nickel series are not useful, since in many cases it may be more desirable to have an alloy which is resistant to corrosion or which retains its strength at high temperature rather than to have one which has a superior hardness at ordinary temperatures.

The Heat Treatment of Aluminum-Magnesium-Copper Alloys.- This work was done with the purpose of discovering the best heat treatment conditions for the aluminum-magnesium-copper alloys. Duralumin, an alloy of this series, has been heat treated commercially by quenching in cold water from approximately 520°C., followed by aging at ordinary temperatures. Extensive tests made by varying the temperature of quenching and the time and temperature of aging, have led to the conclusion that the properties obtained by heat treatment are quite dependent upon the heat treatment conditions. A much better heat treatment than the one which has heretofore been used commercially consists in the quenching of alloys of this series from 510° to 520° in a bath having a temperature of from 125° to 150°,

and aging preferably in this bath at the same temperature from 30 to 40 hours, or at an ordinary temperature from 5 to 6 days.

These results were obtained with the cooperation of the Aluminum Company of America, and this firm is now utilizing this revised heat treatment in the production of aluminum alloys of this type.

A great deal of work has also been done on the study of the transformations of the aluminum-magnesium-copper alloy series, with the hope of a better elucidation of the phenomenon of hardening in these alloys.

Respectfully,

S. W. STRATTON

Director.